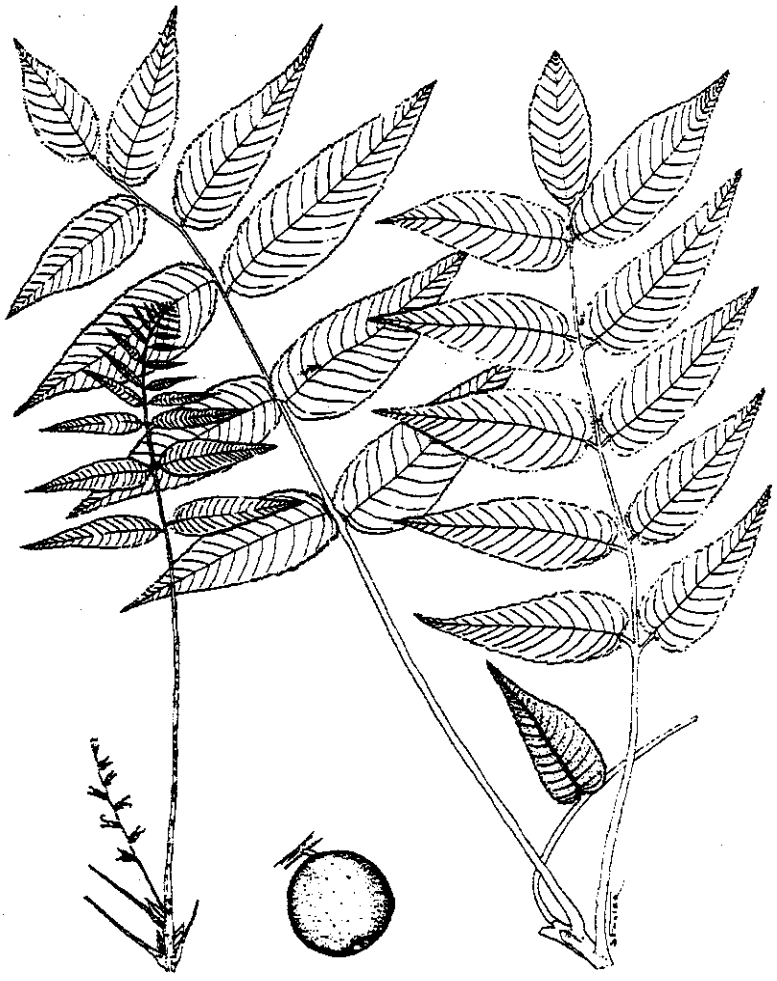
Recovery Plan for

Juglans jamaicensis

Nogal or West Indian Walnut



U.S. Fish and Wildlife Service
Southeast Region
Atlanta, Georgia

RECOVERY PLAN

for

Juglans jamaicensis (Nogal or West Indian walnut)

Prepared by

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U.S. Fish and Wildlife Service
Southeast Region
Atlanta, Georgia

Approved: _____
Regional Director, U.S. Fish and Wildlife Service

Date: 12-9-99

Recovery plans delineate reasonable actions that are believed to be required to recover and/or protect listed species. Plans published by the U.S. Fish and Wildlife Service (Service) are sometimes prepared with the assistance of recovery teams, contractors, State (Commonwealth) agencies, and other affected and interested parties. Plans are reviewed by the public and submitted to additional peer review before they are adopted by the Service. Objectives of the plan will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not obligate other parties to undertake specific tasks and may not necessarily represent the views or the official positions or approval of any individuals or agencies involved in developing the plan, other than the Service. Recovery plans represent the official position of the Service **only** after they have been signed by the Director or Regional Director as **approved**. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

By approving this recovery plan, the Regional Director certifies that the data used in its development represent the best scientific and commercial information available at the time it was written. Copies of all documents reviewed in the development of the plan are available in the administrative record, located at the Boquerón Field Office in Boquerón, Puerto Rico.

Literature citations should read as follows:

U.S. Fish and Wildlife Service. 1999. Recovery plan for *Juglans jamaicensis* (Nogal or West Indian walnut). Atlanta, Georgia. 16 pp.

Additional copies may be purchased from:

Fish and Wildlife Reference Service
5430 Grosvenor Lane, Suite 110
Bethesda, Maryland 20814
Phone: 301/492-6403 or
800/582-3421

Fees for recovery plans vary, depending on the number of pages.

Cover illustration: *Juglans jamaicensis* (Nogal or West Indian walnut): twigs with female flowers (left), leafy twig (right), fruit (below), two-thirds natural size; by S. Foster. In Little *et. al* (1974).

EXECUTIVE SUMMARY

Current Status: *Juglans jamaicensis* (Nogal or West Indian walnut), currently listed as endangered, is a large distinctive tree with fissured (separated into distinct areas by narrow cracks) bark, which may reach up to 25 meters (82 feet) in height. This species is known from Cuba, Hispaniola, and Puerto Rico, but little information is available on its status in the first two countries. In Puerto Rico, this species is known from only 14 individuals at one locality in the municipality of Adjuntas.

Habitat Requirements and Limiting Factors: The known locality is near the Monte Guilarte Commonwealth Forest, but is in private ownership and threatened by land-clearing for agriculture and rural development. Surrounding areas are currently planted in coffee and their expansion may threaten these trees. The wood of the species is also reported to be of good quality, therefore, trees may have been cut in the past for the use of the wood. The area falls within the subtropical lower montane wet forest life zone.

Recovery Objective: Delisting.

Recovery Criteria: *Juglans jamaicensis* may be considered for delisting when (1) protection of the known population has been achieved, through landowner agreement or acquisition, and (2) new populations (the number of which should be determined following the appropriate studies) capable of self perpetuation (reproducing and maintaining a stable population) have been established within protected areas, such as the Monte Guilarte or Toro Negro Commonwealth Forests.

Actions Needed:

1. Protect the existing population and its habitat through the development and implementation of a landowner agreement or through land acquisition.
2. Monitor known populations and survey for additional populations.
3. Enforce existing Commonwealth and Federal endangered species regulations.
4. Educate the public on conservation values and regulations.
5. Conduct research on the life history of the species and evaluate propagation techniques.
6. Conduct propagation and enhance existing populations or establish new ones on protected lands.

Recovery Costs: Recovery costs for *Juglans jamaicensis* have been estimated at $80,000 for the first 3 years. Subsequent expenditures will depend upon the results of these preliminary studies, and therefore, cannot be estimated at this time.

Date of Recovery: Delisting could be initiated in 2025, if the recovery criteria are met.

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PART I. INTRODUCTION

Juglans jamaicensis (nogal or West Indian walnut) is a large distinctive tree and is known from only 14 individuals at one locality in the municipality of Adjuntas, in the central mountains of Puerto Rico. The area is located near the Monte Guilarte Commonwealth Forest but is in private ownership and threatened by land-clearing for agriculture and rural development. The wood of the species is reported to be of good quality and trees may have been cut in the past for such purposes. This species is also known from the islands of Cuba and Hispaniola.

This species was determined to be an endangered species on January 10, 1997, pursuant to the Endangered Species Act of 1973, as amended (U.S. Fish and Wildlife Service 1997). Critical habitat has not been designated for this species because of the risks of vandalism, as well as its potential for overcollection.

Description

Juglans jamaicensis (nogal or West Indian walnut), of the family Juglandaceae, was first described as *J. jamaicensis* by DeCandolle from a description and illustration of leaves, staminate catkin (dense flower cluster with stamens) and fruit which had been prepared by Descourtilz. The tree depicted in the illustration had been published under the name of *Juglans fraxinifolia*. DeCandolle mistakenly believed that the tree Descourtilz had illustrated originated in Jamaica, when in reality no walnut tree has ever been located in Jamaica. Synonyms which have been applied to the species include *Juglans fraxinifolia* Descourtilz, *J. cinerea* of Bello, *J. insularis* Griseb., *J. portoricensis* Dode, and *J. domingensis* (Proctor 1992).

Nogal is a large distinctive tree with fissured bark which may reach up to 25 meters (82 feet) in height. Twigs, buds, and leaf axes have minute rusty hairs. The leaves are alternate (growing at alternating intervals on either side of the stem) and compound (having two or more leaflets born on single stalk) and consist of from 16 to 20 mostly paired, nearly stalkless leaflets (small leaf or segment of a compound leaf). Leaflets are from 5.5 to 9.0 centimeters (2.2 to 3.5 inches) long and 2.2 to 4.0 centimeters (0.9 to 1.6 inches) wide, thin and nearly hairless, except on the veins beneath. Leaflets are lanceolate (narrow and tapering at each end), finely toothed, long-pointed and rounded, and unequal at the base. Nogal is monoecious; male and female flowers are borne in different clusters or catkins on the same tree. Staminate or male flowers are numerous and in drooping catkins, 8.8 to 11.0 centimeters (3.5 to 4.3 inches) long, that are borne on the twigs of the previous year. Pistillate or female flowers are several along an axis, 4.4 to 8.8 centimeters (1.7 to 3.5 inches) long, borne at the ends of the shoots of the season. Individual male flowers are composed of a 6-lobed calyx (outer protective covering of a flower) and many stamens (pollen producing reproductive organ of a flower). Female flowers are about 0.5 centimeters (0.2 inches) long, composed of a 4-toothed scale opening at one side and 4 sepals (one of the segments forming the calyx). The fruit, a drupe, is a walnut which is composed of a blackish husk, a brown rough-ridged hard shell

from 1.6 to 2.75 centimeters (0.6 to 1.1 inches) wide and one large, oily, edible seed (Little et al. 1974, Proctor 1992).

Distribution/Population Status

Nogal is known from Cuba, Hispaniola, and Puerto Rico, but little information is currently available on its status in the first two countries (Liogier and Martorell 1982). The Center for Plant Conservation (1992) described it as "not common" and Proctor (1992) stated it was becoming increasingly rare on these two islands.

Nogal was first collected from Puerto Rico by Augustin Stahl around 1865. This collection was from an area between Peñuelas and Adjuntas at an elevation of approximately 700 meters (2,297 feet). The German botanist Paul Sintenis subsequently collected the species in 1886 from somewhere near Adjuntas (Saltillo) and again in 1887 near Utuado (Santa Rosa). An additional collection was made by Bartolomé Barcela in 1915 from an area near Adjuntas (Little *et al.* 1974, Proctor 1992). Little *et al.* (1974) stated that the species might possibly be extinct.

Juglans jamaicensis was not reported again until 1974, when it was rediscovered by Roy O. Woodbury from the upper north slopes (an elevation of 1,070 meters or 3,510 feet) of Cerro La Silla de Calderón, an area located near the southwest corner of the municipality of Adjuntas. A survey of these trees made in 1992 by Salvador Alemañy of the U.S. Forest Service located a total of 14 individuals, the largest of which was more than 20 meters (66 feet) in height. The species has been reported from montane forests at elevations between 700 and 1,000 meters (2,297 and 3,281 feet) (Proctor 1992).

Habitat Description

Nogal or the West Indian walnut is found on lands adjacent to the Monte Guilarte Commonwealth Forest in the central mountains of Puerto Rico. The mountains are upper Cretaceous, volcanic in origin. Soils are derived from these fine-grained igneous (volcanic) rocks and are high in permeable clay and low in silt and sand. Red or purplish in color, the well-drained soils have a very acidic subsoil (layer of soil beneath the surface soil). The most widely distributed soil is the Los Guineos series (Department of Natural Resources 1976).

Mean annual precipitation in the Monte Guilarte Commonwealth Forest is 2244 millimeters (88.3 inches), with a drier period occurring in the months of January and February and a wetter season occurring from August through October. Mean annual temperature is 20.1°C (68.2°F), with a mean monthly minimum of 20°C (68°F) in February and a mean monthly maximum of 23°C (73.4°F) in July, August and September (Department of Natural Resources 1976).

The area of the known population falls within the subtropical lower montane wet forest life zone (Ewel and Whitmore 1973). Four vegetation associations have been described in the Monte Guilarte Commonwealth Forests. Upper slopes are covered by sierra palm (*Prestoea montana*) forest interspersed with forest dominated by caimitillo (*Micropholis garcinifolia*) and granadillo (*Buchenavia capitata*). High peaks and exposed ridges are characterized by a dwarf or elfin forest which is dominated by evergreen, gnarled, small-leaved species. Lower slopes and valleys were originally planted in coffee under shade trees (e.g., *Inga* sp., *Citrus* sp.).

Reasons For Listing

Nogal was listed as endangered in January of 1997. The tree is known only from Cuba, Hispaniola, and Puerto Rico. Information from the Center for Plant Conservation (1992) indicates that it is rare on the first two islands. In Puerto Rico, it is known from only one population consisting of 14 individuals on privately-owned land. Surrounding areas are currently planted in coffee and their expansion may threaten these trees. The conversion of "shade coffee" to "sun coffee" is of particular concern, since all shade trees are eliminated in such plantations. The known population is located in a rural area, therefore, development for housing may also threaten the species.

The wood of the species is described as being of good quality and highly prized. It has been reported to have been cut in the past for such reasons (Little *et al.* 1974). Because of its limited distribution, the risk of extinction is extremely high. Natural events, such as hurricanes, can dramatically affect forest species composition and structure, felling large trees and creating numerous canopy gaps.

Conservation Measures

Conservation measures provided to federally listed species include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain practices. Recognition through listing encourages and results in conservation actions by Federal, State, and private groups and individuals. The Endangered Species Act provides for possible land acquisition in cooperation with the States and requires that recovery actions be carried out for all listed species. Section 7(a) of the Act, as amended, requires Federal agencies to evaluate their actions with respect to any species that is listed as federally endangered or threatened. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into formal consultation with the Service.

While available information indicates that the trees have not reproduced naturally in the past, they have served as a source of seed. The seed has been used to propagate seedlings in nurseries of the Puerto Rico Department of Natural and Environmental Resources, the Puerto Rico Conservation Trust, and the International Institute of Tropical Forestry.

Recovery of nogal or *Juglans jamaicensis* will involve the protection of the known population in Adjuntas, Puerto Rico, research on aspects of the species' life history, and propagation and the establishment of new populations in protected areas. Exchange of information on the species with countries where the species has also been reported (Hispaniola and Cuba) should also be considered important in the recovery program for the species.

Summary of Comments Received

A copy of the Technical/Agency Draft Recovery Plan for *Juglans jamaicensis* was sent to 13 reviewers, including three peer reviewers, for review and comments. A notice of availability of the Technical/Agency Draft was published in the Federal Register in September of 1998. One letter of comment was received.

The U.S. Department of Housing and Urban Development, Caribbean Office, commented in a letter of January 19, 1999. The letter stated that they did not anticipate that their program in the Adjuntas area would affect the species.

PART II. RECOVERY

A. Recovery Objective/Criteria

The objective of this recovery plan is to provide direction for reversing the decline of *Juglans jamaicensis* and for restoring the species to a self-sustaining status, thereby permitting it to be removed from the Federal List of Endangered and Threatened Wildlife and Plants.

We will consider delisting *Juglans jamaicensis* when (1) protection of the known population has been achieved (through means which may include acquisition, landowner agreement) and (2) new populations (the number of which should be determined following the appropriate studies) capable of self perpetuation have been established within protected areas, such as the Monte Guilarte or Toro Negro Commonwealth Forests. These are minimum requirements, and could be expanded upon if the regenerative or propagative potential of natural and *ex situ* populations proves to be insufficient. Alternatively, if new populations of the species are discovered, it may be preferable to place greater emphasis on protection rather than on propagation in order to achieve the minimum number of plants necessary for recovery.

B. Narrative Outline

1. **Prevent further habitat loss and population decline.** Appropriate public agencies should initiate protection of habitat and individual plants at the known population site.

    11. **Protect habitat.** The protection of the one known population should be given the highest priority.

        111. **Develop a landowner agreement which provides for the long-term protection and recovery of *Juglans jamaicensis*.** An agreement should be developed which includes measures to protect known individuals and their habitat and provides for long-term monitoring of their growth and reproduction. Acquisition may be evaluated as an option for protection of the site as well.

    12. **Protect and monitor plants.** Individual plants and the recruitment of new individuals must be monitored on a long-term basis.

        121. **Monitor known population.** Individual plants should be measured and marked. Basic field observations which will contribute to the information available on population behavior (including phenology (study of periodic phenomena such as flowering), seed production, seed dispersal, recruitment (adding new individuals to a population) success, site changes, and growth), should be made at regular intervals.

        122. **Enforce existing Commonwealth and Federal endangered species regulations.** The Commonwealth Department of Natural Resources' (DNER) Regulation to Govern the Management of Threatened and Endangered Species of 1985 provides for criminal penalties for the illegal take of listed plant species on public land. In addition, development projects that occur in these areas are often funded through local or Federal agencies or require local permits. The Regulation's Section 10 provides for consultations on endangered species that may be affected by a particular project similar to Section 7 of the Endangered Species

Act. Section 7 of the Endangered Species Act applies where Federal lands or federally funded or permitted projects are involved.

123. **Educate the public on plant conservation values and regulations**. *Juglans jamaicensis* should be included in the illustrated brochure and slide presentation (in both English and Spanish) on endangered plants and plant communities that are presented to local school groups, organizations, and agencies. Permitting and funding agencies (those potentially involved in Section 7 consultations) should be made aware of endangered plants, the pertinent laws, and their responsibilities.

2. **Continue to gather information on the distribution and abundance of *Juglans jamaicensis***. Future management decisions and the establishment of recovery priorities depend on obtaining additional information concerning the distribution and abundance of this species.

21. **Search for new populations**. Searches for new individuals and populations should be conducted in areas such as the Commonwealth Forests of the central mountains (e.g., Monte Guilarte, Toro Negro). Private lands with appropriate habitat should also be searched.

211. **Identify and inventory potential sites**. Based on a characterization of known habitat types, potential population sites should be identified and searched. The species' known habitat is limited in extent, therefore facilitating searches.

212. **Characterize sites to determine their suitability as future recovery sites**. If new populations are discovered, this information should be added to the database of the various agencies and organizations involved. In addition, newly discovered sites should be evaluated for the availability of propagative material and the potential for protection.

3. **Conduct research**. Little biological information is available on *Juglans jamaicensis*. Studies should focus on those aspects of life history that may be critical to the recovery of the species.

31. **Define habitat requirements.** Information available from existing studies should be evaluated to more clearly define habitat requirements.

32. **Study reproductive biology and ecology of *Juglans jamaicensis*.** Effective management and recovery of this species depends upon obtaining this information.

    321. **Assess periodicity of flowering.** Studies to determine the frequency, timing, and abundance of flowering; pollination mechanisms; and the physical and biological factors controlling these events should be continued.

    322. **Assess seed production and dispersal.** Agents of seed predation and/or dispersal should be identified.

    323. **Evaluate seed viability and germination requirements.** Information on the environmental conditions required for germination should be obtained through field and laboratory studies.

    324. **Evaluate requirements for establishment and growth.** Field and laboratory experiments should focus on this critical stage to determine the factors that affect establishment and survival.

    325. **Determine genetic structure of the species.** Study intrapopulation genetic diversity of the species using appropriate techniques.

33. **Evaluate techniques for artificial propagation and develop propagation program.** Propagation techniques should be evaluated so that a propagation program with local nurseries may be developed. Information available from ongoing efforts by the DNER, the Puerto Rico Conservation Foundation, and the International Institute of Tropical Forestry (IITF) should be compiled and utilized in these efforts.

    331. **Assess methods of propagation.** Based on the availability of propagative material, economic and logistical considerations, and results from the above research, determine the most feasible method of

propagation and transplantation to existing or new sites. Sexual vs. asexual reproduction should be evaluated as alternatives.

332. **Develop artificial propagation program.** This species is currently being propagated and distributed by the DNER, Puerto Rico Conservation Trust, and the IITF. This should be continued and emphasis should be placed on the need for adequate record-keeping. Priority should be given to production for establishment of new populations rather than for use as ornamentals.

4. **Establish new populations.** Areas for the establishment of new populations of *Juglans jamaicensis* should be selected and new populations established.

41. **Select appropriate sites for population introduction or enhancement using artificially propagated material.** Habitat requirements must be considered in order to assure the success and relevance of transplanting propagated material.

411. **Select sites and assess habitat suitability.** Using information from Task 31, inventory potential sites for the introduction and establishment of new populations of *Juglans jamaicensis*. Consideration should be given to the introduction of this species in areas of the Monte Guilarte Commonwealth Forest or in the Toro Negro Commonweatlh Forest.

412. **Ensure site protection.** If proposed sites are not already on protected land, steps must be taken to provide for their protection. Management plans for these new sites should be developed or modified to include considerations for this species.

413. **Introduce and monitor plants.** Success of plantings should be carefully monitored.

5. **Refine recovery criteria.** As additional information on the biology, ecology, propagation, and management of *Juglans jamaicensis* is accumulated, it will be necessary to better define, and possibly modify, recovery criteria.

51. **Determine number of individuals and populations necessary to ensure species stability and self-perpetuation.** Environmental and reproductive studies, together with the relative success of population protection measures, will allow for more precise and realistic recovery criteria to be established.

52. **Determine what additional actions, if any, are necessary to achieve recovery criteria.** If there are any actions not included in this recovery plan which during the recovery process become recognized needs, they should be incorporated into the plan.

C. Literature Cited and References

Center for Plant Conservation. 1992. Report on the Rare Plants of Puerto Rico. Missouri Botanical Garden, St. Louis, Missouri.

Department of Natural Resources. 1976. The Master Plan for the Commonwealth Forests of Puerto Rico. San Juan, Puerto Rico. 259 pp.

Ewel, J.S. and J.L. Whitmore. 1973. Ecological life zones of Puerto Rico and the U.S. Virgin Islands. USDA Forest Serv. Res. Paper ITF-18. 72 pp.

Liogier, H.L. and L.F. Martorell. 1982. Flora of Puerto Rico and Adjacent Islands: a systematic synopsis. Editorial de la Universidad de Puerto Rico, Río Piedras, Puerto Rico. 342 pp.

Little, E.L., Jr., R.O. Woodbury, and F.H. Wadsworth. 1974. Trees of Puerto Rico and the Virgin Islands, Volume II. Agriculture Handbook No. 449. U.S. Department of Agriculture, Forest Service. Washington, D.C. 1024 pp.

Proctor, G.R. 1992. Status report on *Juglans jamaicensis* C. DC. Unpublished report submitted to the U.S. Fish and Wildlife Service. 7 pp.

U.S. Fish and Wildlife Service. 1997. Endangered and threatened wildlife and plants; determination of endangered status for *Juglans jamaicensis*. Federal Register Vol. 62: 1691.

PART III. IMPLEMENTATION SCHEDULE

Priorities in column 1 of the following Implementation Schedule are assigned as follows:

Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

Priority 2 - An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.

Priority 3 - All other actions necessary to provide for full recovery of the species.

List of Abbreviations

DNER - Puerto Rico Department of Natural and Environmental Resources
ES - Ecological Services Division, U.S. Fish and Wildlife Service
LE - Law Enforcement Division, U.S. Fish and Wildlife Service
BotGar - Botanical Gardens
Univ. - Universities
PRCF - Puerto Rico Conservation Foundation

IMPLEMENTATION SCHEDULE

Task Priority	Task Description	Task Number	Task Duration (Years)	Responsible Organization FWS R4	Responsible Organization Other	Cost Estimates ($000) FY1	FY2	FY 3	Comments
1	Develop a landowner agreement which provides for the long term protection and recovery of *Juglans jamaicensis*.	111	2	ES	DNER				No cost anticipated.
1	Monitor known populations.	121	Cont.	ES	DNER	3	3	3	
1	Enforce existing Commonwealth and Federal endangered species regulations.	122	Cont.	ES, LE	DNER	6	6	6	
2	Educate the public on plant conservation values and regulations.	123	Cont.	ES, LE	DNER	1	1	1	
2	Identify and inventory potential sites.	211	2-4	ES	DNER	3	3	3	
2	Characterize sites to determine their suitability as future recovery sites.	212	2-4	ES	DNER, Univ.				
2	Define habitat requirements.	31	2-4	ES	DNER, Univ.	3	3	3	
2	Assess periodicity of flowering.	321	2-4	ES	DNER, Univ.	6	6	6	6K/year includes 321, 322, 323, 324, and 325.
2	Assess seed production and dispersal.	322	2-4	ES	DNER, Univ.				

Task Priority	Task Description	Task Number	Task Duration (Years)	Responsible Organization FWS R4	Responsible Organization Other	Cost Estimates ($000) FY1	FY2	FY 3	Comments
2	Evaluate seed viability and germination requirements.	323	2-4	ES	DNER, Univ.				
2	Evaluate requirements for establishment and growth.	324	2-4	ES	DNER, Univ.				
2	Determine genetic structure of the species.	325	2-4	ES	DNER, Univ.				
2	Assess methods of propagation.	331	2-4	ES	DNER, Univ. BotGar., PRCF	2	2	2	
2	Develop artificial propagation program.	332	Cont.	ES	DNER, Univ. BotGar., PRCF	2	2	2	
2	Select sites and assess habitat suitability.	411	2-4	ES	DNER, Univ., PRCF		2		
2	Ensure site protection.	412	2-4	ES	DNER,				
2	Introduce and monitor plants.	413	2-4	ES	DNER				
2	Determine number of individuals and populations necessary to ensure species stability and self-perpetuation.	51	Cont.	ES	DNER, Univ.				
2	Determine what additional actions are needed to achieve recovery criteria.	52	Cont.	ES	DNER, Univ.				

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